

#### **8.4 The student will demonstrate an understanding of the characteristics, structure, and predictable motions of celestial bodies. (Earth Science)**

##### **Key Concepts:**

**Solar system:** planet, moon, asteroid, comet, meteor/meteoroid/meteorite

**Sun:** photosphere, corona, sunspots, prominences, solar flares, solar wind, auroras

**Movements:** revolution, rotation, day, axis, year, seasons, equinox, elliptical orbit

**Moon:** phases of the Moon, eclipses, solar eclipse, lunar eclipse, tides, spring tide, neap tide

**Gravity:** mass, weight

**Galaxies:** elliptical, spiral, irregular, light year

**Tools:** telescopes, satellites, space probes, spectroscopes

##### **Supporting Content Web Sites**

Solar and Heliospheric Observatory (SOHO)

<http://sohowww.nascom.nasa.gov/>

Provides the most recent images of the Sun as well as an extensive archive of information and animations about solar phenomenon. Includes images of flares, prominences, eclipses, and sunspots.

8-4.2, 8-4.3, 8-4.4

NASA Astronomy Picture of the Day

<http://antwrp.gsfc.nasa.gov/apod/astropix.html>

A daily image from a satellite, telescope, or observatory that is accompanied by an astronomer's description of the significance of the picture. There is an extensive archive of previous entries and each image is hyperlinked to additional related images.

8-4.1, 8-4.10

NASA Jet Propulsion Laboratory: Welcome to the Planets

<http://pds.jpl.nasa.gov/planets/welcome.htm>

Provides factual information for each planet and some smaller bodies with details about the exploratory missions that have provided the information. Also includes a gallery of images for each artifact collected during recent expeditions.

8-4.1, 8-4.10

University Corporation for Atmospheric Research: Windows to the Universe Solar System News

[http://www.windows.ucar.edu/tour/link=/headline\\_universe/solar\\_system/solar\\_system.html](http://www.windows.ucar.edu/tour/link=/headline_universe/solar_system/solar_system.html)

An extensive collection of links to news articles and press releases about recent space expeditions including those of the most recent space probes. Hyperlinked terms will reveal additional information about shuttle missions, probes, satellites and telescopes.

8-4.10

#### AmazingSpace Online Explorations

<http://amazing-space.stsci.edu/resources/explorations/>

Home page for nine on-line explorations and interactive games that include Galaxies Galore, Galaxy Hunter, Build a Comet, Comet Facts, Myths, and Legends, Planet Impact, and Telescopes from the Ground Up.

8-4.1, 8-4.9, 8-4.10

#### AmazingSpace Comparison of Galaxies

[http://amazing-](http://amazing-space.stsci.edu/resources/organizers/galaxy.php.p=Astronomy+basics%40%2Ceds%2Castronomy-basics.php&a=%2Ceds)

[space.stsci.edu/resources/organizers/galaxy.php.p=Astronomy+basics%40%2Ceds%2Castronomy-basics.php&a=%2Ceds](http://amazing-space.stsci.edu/resources/organizers/galaxy.php.p=Astronomy+basics%40%2Ceds%2Castronomy-basics.php&a=%2Ceds)

Graphic organizer that compares spiral, elliptical, and irregular galaxies.

8-4.9

#### Nova Online: To the Moon Lunar Puzzlers

<http://www.pbs.org/wgbh/nova/tothemoon/puzzlers.html>

Interactive site showing an animation of the relationship of the motion of the Moon relative to the Earth. Includes an explanation of the lunar calendar and phases of the moon.

8-4.4

#### Nova Online: Sinking City of Venice What Causes the Tides?

<http://www.pbs.org/wgbh/nova/venice/tides.html>

What Causes the Tides is an animation of the Sun-Earth-Moon system that illustrates the effect of gravity on tides, the relationship between distance, mass, and gravity, and a comparison of tides during different phases of the moon. Tidal Anomalies provides explanations of single high tides, neap tides, and time lags.

8-4.4, 8-4.6, 8-4.7

#### Atlas of the Universe

<http://www.answers.org/free/universe/>

This universal equivalent of Mapquest provides multiple representations of the universe at various light-years from our Sun. Each frame is 10-20 times farther out than the preceding one.

8-4.9

### **Suggested Literature**

Nardo, D. (2003). *The Lucent library of science and technology-comets and asteroids*. Chicago, IL: Lucent Books.

ISBN: 1590182863

Lexile: not available

Summarizes how comets were formed, outlines their shapes, sizes, and orbits and explains the danger of a potential impact with Earth. The text also discusses several space flights that have collected data from comets and asteroids.

8-4.1, 8-4.10

Ride, S. & O'Shaughnessy, T. (2003). *Exploring our solar system*. New York, NY: Crown Books.

ISBN: 0375812040

Lexile: not available

Photographs and satellite imagery illustrate a journey that begins at the sun and moves past each of the planets. Graphics and charts are used to outline the physical characteristics of each planet, while the accompanying discussion by astronaut Sally Ride compares how the planets were formed, what surface conditions are like, and the probability of finding life on each one.

8-4.1, 8-4.2

Jackson, E. (2002). *Looking for life in the universe*. Boston, MA: Houghton Mifflin.

ISBN 0618128948

Lexile: not available

An intriguing look at cutting-edge space science from the viewpoint of Jill Tartar, an astrophysicist at the SETI institute. Includes a pictorial daily journal of the work of a SETI researcher and an in-depth discussion of how a radio telescope is used to collect information from deep space.

8-4.10

Spangenburg, R. & Moser, K. (2001). *A look at the sun*. New York, NY: Franklin Watts.

ISBN: 0531165655

Lexile: 1180

A detailed summary of the structural components of the sun as provided by evidence from solar probes. Includes a discussion of the impact of the Sun on Earth including providing energy for photosynthesis and creating disturbances of communication systems.

8-4.2, 8-4.3, 8-4.10

Carruthers, M. W. (2003). *The moon*. New York, NY: Franklin Watts.

ISBN: 0531163733

Lexile: 1040

Summarizes what we know about the moon from observations made on Earth and evidence collected during space missions with a special emphasis on the geology and landforms of the Moon's surface in comparison to that of Earth. Includes a discussion of phases of the moon, lunar eclipses, and gravity.

8-4.1, 8-4.6, 8-4.7, 8-4.8

Kerrod, R. (2002). *The far planets*. Austin, TX: Raintree Steck-Vaughn.

ISBN: 0739828207

Lexile: not available

Combining this book with *The Near Planets* (ISBN: 0739828193), which is also a part of this Exploring the Universe Series, would provide a comprehensive comparison of the atmospheric and surface characteristics of the planets.

8-4.1

Dickinson, T. (1998). *Nightwatch: a practical guide to viewing the universe*. Ontario, Canada: Firefly Books.

ISBN: 1552093026

Lexile: not available

Considered to be one of the best nighttime field guides for the beginning sky-watcher, the photographs in this book were actually taken by amateur astronomers.

8-4.1, 8-4.10

Bond, P. (1999). *DK Guide to space: a photographic journey through the universe*. New York, NY: DK Publishing.

ISBN: 0-7894-3946-8

Lexile: not available

Two-page layouts include images from the Hubble Telescope and other space probes to give an illustration of the physical characteristics of the Sun, the Moon, planets, comets, and galaxies.

The photographs are accompanied by detailed captions and descriptive text. Also includes images and explanation of a solar eclipse.

8-4.1, 8-4.4

Scott, E. (1994). *Close encounters: exploring the universe with the Hubble Space Telescope*.

New York: Hyperion Books.

ISBN: 0786801476

Lexile: not available

Images from the Hubble Space Telescope are accompanied by engaging narration of the significance of the images. Includes encounters with Mars, Venus, and Saturn as well as the deepest view we have of outer space.

8-4.1, 8-4.10

Miller, R. (2005). *Stars and galaxies (worlds beyond)*. Breckenridge CO: Twenty-First Century Books.

ISBN: 0761334661

Lexile: not available

Though the first chapters discuss characteristics and life cycles of stars which are beyond the scope of the standards, chapters six and seven provide excellent information about The Milky Way and other galaxies.

8-4.9

## **Suggested Streamline Video Resources**

### **Physical Science: Forces and Gravity**

Gravity in Space

ETV Streamline SC

Begins with a comparison of the gravity on Earth and on the Moon, and then describes the role of gravity in keeping moons and planets in their orbits. Summarizes the process of launching rockets, satellites, and probes into space by controlling the balance of forces, and then illustrates how probes are sent farther into space using the gravitational pull of other planets.

(3:54)

8-4.6, 8-4.7, 8-4.8, 8-4.10

### **A Spin Around the Solar System: How the Solar System Works**

Gravity and Inertia

ETV Streamline SC

Colorful, animated graphics illustrate the combined effect of mass and distance on the force of gravity between the Sun and its planets, the effect of gravity and inertia on the orbit of planets around the Sun, and the role of inertia in keeping the planets spinning on their axes.

(2:01)

8-4.6, 8-4.7

### **Basics of Physics: Exploring Gravity**

Mass and Weight

ETV Streamline SC

Segment one very clearly compares mass to weight using both video from lunar expeditions and graphic animations.

(2:07)

8-4.8

### **What's Out There? Our Solar System and Beyond**

The Sun

ETV Streamline SC

Provides video of the major features of the sun including the corona during an eclipse and solar prominences. Discusses the elliptical orbits of the planets around the Sun and the role of gravity in creating those orbits.

(2:38)

8-4.2

### **What's Out There? Our Solar System and Beyond**

The Inner Planets

ETV Streamline SC

Describes the characteristics of each of the outer planets using entire and composite photographs taken during space exploration missions and computer animations and simulations.

(10:04)

8-4.1

### **What's Out There? Our Solar System and Beyond**

The Outer Planets

ETV Streamline SC

Describes the characteristics of each of the outer planets using entire and composite photographs taken during space exploration missions and computer animations and simulations.

(10:17)

8-4.1, 8-4.10

### **What's Out There? Our Solar System and Beyond**

Other Heavenly Bodies: Asteroids, Meteors, and Comets

ETV Streamline SC

Animated comparison of the composition of the smaller heavenly bodies including facts about Galileo's encounter with the asteroid Gaspar and the collision of comet Shoemaker Levy with Jupiter.

(2:16)

8-4.1, 8-4.10

### **What's Out There? Our Solar System and Beyond**

Other Galaxies, Other Planets: Are We Alone?

ETV Streamline SC

Discusses the future of space exploration and recent expeditions including the Hubble Telescope.

(2:55)

8-4.10

### **A Spin Around the Solar System: Moon Dance**

The Moon and Tides

ETV Streamline SC

Summarizes the role of the Moon in producing Earth's tides with animations to clearly illustrate the rise and fall of the tides.

(4:00)

8-4.4

### **Exploring Weather: The Atmosphere in Motion**

The Sun and Weather

ETV Streamline SC

Explains the effect of the Sun's energy on the surface of the Earth and ability of different earth materials to absorb or reflect that heat. The second half of the segment summarizes how the tilt of the Earth creates the seasons of the year.

(6:48)

8-4.3, 8-4.5

## **Career Connections**

### **Aerospace engineer**

Aerospace engineers design, construct, and test aircraft, aerospace vehicles, and propulsion systems. They research, develop and test new materials, engines, body shapes, and structures that could lead to an increase in speed and strength of planes, jets, helicopters, gliders, missiles, and spacecraft.

### **Planetarium director/educator**

Planetarium directors use their degree in astronomy to write and produce planetarium programs to educate the community about phenomenon related to space science. They maintain and operate specialized computer and presentation equipment and serve as the community media contact when remarkable events in space occur.

**Astrogeologist**

Astrogeologists study the origin, history, composition, and structure of planets and other celestial bodies. They must be knowledgeable in chemistry, physics, math, biology, and astronomy to analyze data and specimens. Most of their work is done on a computer and not in the field.

**Payload Specialist**

Payload specialists are assigned to a space mission to oversee a specific research project or mechanical task in their field of expertise. The specialist is not necessarily a professional astronaut, but has general knowledge of astronomy and space exploration and trains with the astronauts in order to be physically prepared for the mission.

**Science journalist**

Science journalists with a degree in astronomy or earth science report on space missions and significant discoveries or events in space for magazines, newspapers, radio and television. They require strong oral and written communication skills.